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ABSTRACT

The statistical technique of discriminant analysis was applied to selected remedial education programs within a statewide system of higher education in the Southeastern United States in an effort to explore that technique's potential for identifying student characteristics (variables) that discriminate between those who are successfully remediated as a result of such programs and those who are not. Attention is focused on the remedial programs at a regional university of about 5,000 students, which offered freshmen remedial courses in mathematics, composition, and reading. The discriminant analysis applied to the remedial mathematics course revealed three variables predictive of successful remediation: math pretest score, perceived usefulness of course, and race. For the remedial composition course, the most predictive variables, in order of importance, were age, confidence in ability to master composition, sex, composition pretest score, perceived usefulness of course, and race. Lastly, for the remedial reading course, the reading pretest score and courses's perceived usefulness were the important predictor variables. Descriptions of all the variables and associated codes are included. (Author/SW)

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DISCRIMINANT ANALYSIS APPLIED TO BASIC SKILLS PROGRAMS

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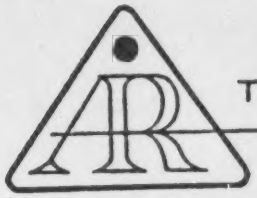

THE ASSOCIATION FOR INSTITUTIONAL RESEARCH

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D. R. Coleman, Chairman
Forum Publication
Advisory Committee

DISCRIMINANT ANALYSIS APPLIED TO BASIC SKILLS PROGRAMS

(ABSTRACT)

The statistical technique of discriminant analysis is applied to selected remedial education programs within a statewide system of higher education in the Southeastern United States in an effort to explore that technique's potential for identifying those student characteristics (variables) which "discriminate" between those who are successfully remediated as a result of such programs and those who are not. The implications of the findings for better informed policies and decisions regarding program planning, admissions and advising are also discussed.

DISCRIMINANT ANALYSIS APPLIED TO BASIC SKILLS PROGRAMS

Introduction and Perspectives

In recent years, tensions between values of quality and equality in American higher education have become increasingly pronounced and pervasive in their effects upon policies being formulated and decisions being made at the national, state and institutional levels. "Project EQuality," a nation wide effort sponsored by the College Board, and the Southern Regional Education Board's Task Force Report on Higher Education and the Schools, "The Need for Quality," are but two examples of a growing number of indications that the quality vs. equality dilemma is becoming a major topic of discussion, argumentation and debate among faculties, administrations, governing boards, and state legislatures and executive offices (Casteen, 1982; SREB, 1981).

One can hardly address this sensitive and potentially explosive topic without confronting simultaneously the closely related issue of the need for or place of remedial education in higher education. For example, the SREB Task Force report considers the challenge of "Finding the most effective setting for remedial studies," and takes the position that, "In the long term, the need for remedial education at the college level should be reduced substantially by measures at elementary and secondary levels to improve student performance" (SREB, 1981, p. 19). The report also includes the formal recommendation that, "The state boards of education and higher education in each state should appoint a joint committee to examine remedial education provided within their state, for the purpose of determining the most effective settings and models to serve the needs of insufficiently prepared high school graduates" (SREB, 1981, p. 19).

The need for finding "solutions" to the "problem" of remedial education becomes particularly urgent when it is recognized that the costs of remediation have risen dramatically in recent years. According to a recent SREB report, "Several states are now collecting cost information on remediation at the college level. California recently completed a study of its public colleges and universities which indicates that expenditures for remediation increased 42 percent in the two year period from 1978-79 to 1980-81... At campuses in the California State University System, expenditures rose 97 percent. [And] of the $80 million the public institutions spent for remediation in 1980-81, 92 percent came from State funds. Very little cost data for other states are available, but indicators suggest similar increases in most state systems of higher education" (SREB, 1983, p. 2).

As the various academic policy and budgetary alternatives are considered in the several political environments, sound and convincing evidence regarding the effectiveness and efficiency of collegiate remedial instruction programs will be sought, and institutional researchers will be among those whose expertise will be directed toward designing and conducting evaluation studies of remedial programs.

Purpose

The purpose of the current research is to apply the statistical technique of discriminant analysis to selected remedial education programs within a statewide system of higher education in the Southeastern United States in an effort to explore that technique's potential for identifying those student

characteristics (variables) which "discriminate" between those who are successfully remediated as a result of such programs and those who are not.

To the extent that discriminant analysis allows the identification of variables and, hence, types of students, which are related to successful or non-successful remediation, more informed and cost-effective policies and decisions regarding such matters as remedial education programming, pedagogical techniques, admissions and advising should result. Unlike the more traditional approaches to evaluation, which entail implementation of a variety of experimental or quasi-experimental designs and which are ordinarily utilized primarily or exclusively for purposes of summative evaluation (Akst and Hecht, 1980; Dumont, Jones, and Bekus, 1982), discriminant analysis would appear to have greater potential for more applications to formative evaluations.

Literature review

Institutional researchers are able to refer to a growing body of literature on both the rationale and the methodology of program evaluation. Representative of recent contributions are the efforts of Anderson and Ball (1978), Anderson, Ball, Murphy, and Associates (1973), Astin (1970a; 1970b; 1974), Baird (1977), Balderston (1974), Bowen (1974; 1977), Cooley (1976), Dressel (1972; 1976), Feldman (1970), Fincher (1978a; 1978b; 1979), Folger (1977), Hartnett (1971), Lenning, Lee, Micek, and Service (1977), Miller (1979), Pedazur (1975), and Rock, Centra, and Linn (1969), to cite but a few. While much of the literature on program evaluation has focused upon the assessment of "general education" and "major field" processes and outcomes, it is also evident that remedial education programs have become the

subjects of serious, scholarly attention (Baldwin and others, 1975; Carman, 1971; Cosby, 1975; Cross, 1976; Dumont, Jones, and Bekus, 1982; Entwistle, 1960; Gordon, 1970; Grant and Hoeber, 1978; Maxwell, 1979; Piesco, 1978; Roueche, 1973, 1977; Sharon, 1970; Trillin and Associates, 1980; and Zwick, 1965).

Although a variety of methodological approaches to and techniques of summative evaluation have been reported in the literature (Akst and Hecht, 1980), including multiple-indicator and multiple-design approaches (Dumont, Jones, Bekus, 1982), the potential advantages or benefits of discriminant analysis have yet to be realized, and particularly with regard to formative evaluation.

Discriminant analysis is a statistical procedure which is an extension of multiple regression analysis, and which is applicable in situations where the dependent variable may represent the nominal level of measurement. It allows the assignment of individuals to two or more categories or groups based upon information on two or more variables. Kerlinger (1979, pp. 222-223) has summarized the distinguishing characteristics and potentials of the technique as follows: "On the basis of theory, previous knowledge, or hunch, appropriate measures of ability, personality, and other variables are administered to members of known groups. Discriminant analysis is done and discriminant equations...are calculated. The equations are then used to predict the...group memberships of individuals whose group memberships are not known." Kerlinger has also appropriately emphasized the unique capabilities of discriminant analysis as providing a bridge between basic and applied research: "Discriminant analysis is a useful and powerful device in applied research. Suppose, however, a basic researcher is more interested in describing the

differences among groups and in understanding why groups are different. Discriminant analysis can be used to help in such description and understanding" (Kerlinger, 1979, p. 223).

The basic and applied aspects of discriminant analysis have also been emphasized by Klecka in terms of the technique's capabilities with regard to both analysis and classification: "The analysis aspects of this technique provide several tools for the interpretation of data....The weighting coefficients...serve to identify the variables which contribute most to differentiation along the respective dimension (function)." And, "The use of discriminant analysis as a classification technique comes after the initial computation. Once a set of variables is found which provides satisfactory discrimination for cases with known group memberships, a set of classification functions can be derived which will permit the classification of new cases with unknown memberships" (Klecka, 1975, pp. 435-436).

Data sources

Our data derive from a project designed to evaluate the effectiveness of remedial education programs in mathematics, composition and reading within a statewide system of higher education in the Southeastern United States. The project is sponsored by the system governing board, and it was initiated in the Fall of 1979 as a pilot effort involving one of the system's six regional universities and one of its ten community colleges. The project was expanded in the Fall of 1981 to include two additional community colleges.

At each participating institution, a multiple-indicator and multiple-design summative evaluation strategy has been adopted, utilizing both short- and long-range post-program measures. In the interest of a reasonably

parsimonious presentation, we will focus our attention upon the remedial programs at but one of the institutions, a regional university of approximately 5000 students.

An SPSS file has been developed which contains the records of first-time freshmen enrolled in remedial education courses in mathematics, composition and reading in the Fall Quarter of 1979. Data are available on such predictor variables as age, sex, race, entering ability as assessed by ACT scores and scores on "local" subject matter (mathematics, composition and reading) achievement pretests, posttests and gain scores, as well as on performance in subsequent related courses. Additionally, attitudinal data were gathered via self-administered questionnaires given both at the beginning and at the end of the remedial courses. Factor analyses applied to Likert-type items yielded two distinct, strong and quite consistent factors upon pretest,"Perceived Usefulness of Course" and "Confidence in Ability to Master the Subject Matter," and one factor upon posttest, "Perceived Usefulness of Course." Summaries of the results of the factor analyses of the attitudinal items appear in Tables 6 through 8 for the remedial courses in mathematics, composition and reading, respectively.

Analyses

In order to explore both the explanatory and predictive aspects of discriminant analysis, and especially their potential for formative evaluation, five separate analyses utilizing SPSS "Subprogram Discriminant" were applied to our data. In each analysis, the two groups which were the subjects of discriminant analysis were the successfully remediated and the non-successfully remediated students and the analysis was intended to

identify those demographic, performance and attitudinal variables which accounted for success or failure of remediation. The classification technique was subsequently applied in order to predict the likelihood of success as a result of remediation.

The first three analyses utilized a short-range postprogram measure of successful remediation, namely, successful completion of the remedial course through earning a grade of C or better. These analyses were conducted for the three program areas of mathematics, composition and reading.

The last two analyses were conducted for mathematics and composition only, and they utilized a long-range postprogram measure of successful remediation, that is, successful completion of next related course through earning a grade of C or better. Reading was excluded from this portion of our inquiry due to the difficulties of identifying clearly what the next related course was or should be. No such ambiguity was encountered with regard to mathematics and composition, since sufficient numbers of students enrolled in the next related course within a required sequence during the Winter Quarter of 1980.

The variables, which were entered into the several discriminant analyses in a stepwise fashion according to the variables' "discriminating power" as determined by the method of Wilk's lambda (see Klecka, 1975, pp. 446-448), are identified and described as follows, for each of the five analyses:

1. Discriminant analysis applied to remedial mathematics, where success of remediation is defined as earning a grade of C or better in the remedial course. Hence, the two groups constituting the focus of the analysis are: (1) Students earning grades of D or F; and (2) Students earning grades of A, B or C.

Variable Descriptions and Codes

Sex of student. Coded as a dummy variable: 0-Female; 1-Male.

Age of student as of September, 1979. Coded as actual age in years.

Race of student. Coded as a dummy variable: 0=Black; 1=White.

ACT Math Subtest Score. Coded as actual standard score.

ACT Composite Score. Coded as actual standard score.

Math Pretest Score. Score on "local" faculty-developed mathematics achievement test administered at the beginning of the remedial course. Coded as actual score 0 - 100.

Quarter Hours, Fall, 1979. Total number of quarter hours for which student was enrolled while taking the remedial mathematics course. Coded as actual number of quarter hours, where 12 hours defines "full-time" status.

Perceived Usefulness of Remedial Mathematics Course. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 6 for the attitudinal statements and their factor loadings.

Confidence in Ability to Master Mathematics. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 6 for the attitudinal statements and their factor loadings.

2. Discriminant analysis applied to remedial composition, where success of remediation is defined as earning a grade of C or better in the remedial course. Hence, the two groups constituting the focus of the analysis are: (1) Students earning grades of D or F; and (2) Students earning grades of A, B or C.

Variable Descriptions and Codes

Sex of student. Coded as a dummy variable: 0=Female; 1=Male.

Age of student as of September, 1979. Coded as actual age in years.

Race of student. Coded as a dummy variable: 0=Black; 1=White.

ACT English Subtest Score. Coded as actual standard score.

ACT Composite Score. Coded as actual standard score.

Composition Pretest Score. Score on "local" faculty-developed composition achievement test administered at the beginning of the remedial course. Coded as actual score 0 - 67.

Quarter Hours, Fall, 1979. Total number of quarter hours for which student was enrolled while taking the remedial composition course. Coded as actual number of quarter hours, where 12 hours defines "full-time" status.

Perceived Usefulness of Remedial Composition Course. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 7 for the attitudinal statements and their factor loadings.

Confidence in Ability to Master Composition. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 7 for the attitudinal statements and their factor loadings.

3. Discriminant analysis applied to remedial reading, where success of remediation is defined as earning a grade of C or better in the remedial course. Hence, the two groups constituting the focus of the analysis are: (1) Students earning grades of D or F; (2) Students earning grades of A, B or C.

Variable Descriptions and Codes

Sex of student. Coded as a dummy variable: 0=Female; 1=Male.

Age of student as of September, 1979. Coded as actual age in years.

Race of student. Coded as a dummy variable: 0=Black; 1=White.

ACT Social Studies Reading Subtest Score. Coded as actual standard score.

ACT Composite Score. Coded as actual standard score.

Reading Pretest Score. Score on Nelson-Denny test of reading ability administered at the beginning of the remedial course. Coded as actual reading grade level.

Quarter Hours, Fall, 1979. Total number of quarter hours for which student was enrolled while taking the remedial reading course. Coded as actual number of quarter hours, where 12 hours defines "full-time" status.

Perceived Usefulness of Remedial Reading Course. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 8 for the attitudinal statements and their factor loadings.

Confidence in Ability to Master Reading. Student's score on this attitudinal variable as assessed at the beginning of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 8 for the attitudinal statements and their factor loadings.

4. Discriminant analysis applied to remedial mathematics, where success of remediation is defined as earning a grade of C or better in the next mathematics course, taken in the quarter immediately following the completion

of the remedial mathematics course. Hence, the two groups constituting the focus of the analysis are: (1) Students earning grades of D or F; and (2) Students earning grades of A, B or C.

Variable Descriptions and Codes

Sex of student. Coded as a dummy variable: 0=Female; 1-Male.

Age of student as of September, 1979. Coded as actual age in years.

Race of student. Coded as a dummy variable: 0=Black; 1=White.

ACT Math Subtest Score. Coded as actual standard score.

ACT Composite Score. Coded as actual standard score.

Math Pretest Score. Score on "local" faculty-developed mathematics achievement test administered at the beginning of the remedial course. Coded as actual score 0 - 100.

Math Posttest Score. Score on "local" faculty-developed mathematics achievement test administered at the end of the remedial course. Coded as actual score 0 - 100.

Math Test Gain Score. Posttest-Pretest gain score on "local" faculty-developed mathematics achievement test. Coded as actual gain.

Quarter Hours, Winter, 1980. Total number of quarter hours for which student was enrolled while taking the next mathematics course. Coded as actual number of quarter hours, where 12 hours defines "full-time" status.

Perceived Usefulness of Remedial Mathematics Course. Student's score on this attitudinal variable as assessed at the end of the remedial course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 6 for the attitudinal statements and their factor loadings.

5. Discriminant analysis applied to remedial composition, where success of remediation is defined as earning a grade of C or better in the next composition course, taken in the quarter immediately following completion of the remedial composition course. Hence, the two groups constituting the focus of the analysis are: (1) Students earning grades of D or F; and (2) Students earning grades of A, B or C.

Variable Descriptions and Codes

Sex of student. Coded as a dummy variable: 0=Female; 1=Male.

Age of student as of September, 1979. Coded as actual age in years.

Race of student. Coded as a dummy variable: 0=Black; 1=White.

ACT English Subtest Score. Coded as actual standard score.

ACT Composite Score. Coded as actual standard score.

Composition Pretest Score. Score on "local" faculty-developed composition achievement test administered at the beginning of the remedial course. Coded as actual score 0 - 67.

Composition Posttest Score. Score on "local" faculty-developed composition achievement test administered at the end of the remedial course. Coded as actual score 0 - 67.

Composition Test Gain Score. Posttest-Pretest gain score on "local" faculty-developed composition achievement test. Coded as actual gain.

Quarter Hours, Winter, 1980. Total number of quarter hours for which student was enrolled while taking the next composition course. Coded as actual number of quarter hours, where 12 hours defines "full-time" status.

Perceived Usefulness of Remedial Composition Course. Student's score on this attitudinal factor as assessed at the end of the remedial composition

course. Actual item response category scores are summed to form a Likert-type scale score ranging from 5 - 25. See Table 7 for the attitudinal statements and their factor loadings.

Results

Selected results of the discriminant analysis applied to the remedial mathematics course are presented in Table 1. The data reveal the emergence of a distinct and statistically significant factor, consisting of three variables predictive of successful remediation. In order of importance, as revealed by their standardized canonical discriminant function coefficients, the variables are Math Pretest Score (.84), Perceived Usefulness of Course (.39), and Race (.38). Therefore, students who score higher on the "local" faculty-developed mathematics achievement test, who have a more positive attitude about their need for and usefulness of the course, and who are white are more likely to be successfully remediated. That these variables in combination have great predictive potential is revealed through an examination of the classification results of Table 1, where 85% of all cases are correctly classified.

Other variables included in our analysis, but which did not emerge as being predictive of successful remediation in mathematics were Sex, ACT Math Subtest Score, ACT Composite Score, Age, Confidence in Ability to Master Mathematics, and the Quarter Hours for which the student was enrolled.

What are the implications of the above findings from the perspective of formative evaluation? While answers to this question are most appropriately formulated by the faculty and administrators of the subject institution, with an awareness of specific circumstances, clientele, and of institutional goals and human and fiscal resources, the data might suggest the

desirability of attempts to identify a cutoff score on the mathematics achievement test which could be utilized for admissions and/or advising purposes, an advisory or orientation program for students aimed at heightening their awareness of the importance of the remedial course for their collegiate and lifelong success, and careful consideration of the possibility of developing ways to better serve the needs of black students.

Table 2 displays the findings of the discriminant analysis applied to the remedial composition course. Once again, a discriminating factor has emerged, although it is neither as distinct nor as statistically significant as that which was observed for the remedial mathematics course. In order of importance, the predictive variables are Age (.63), Confidence in Ability to Master Composition (.61), Sex (-.53), Composition Pretest Score (.42), Perceived Usefulness of Course (.42) and Race (.34). Apparently, more variables are relevant to successful prediction with regard to composition than to mathematics. Successful remediation is more likely if the student is an older female, has an attitude of confidence in her writing ability, scores high on the "local" faculty-developed composition test, and has a positive attitude about her need for and usefulness of the remedial composition course. Although not quite as impressive as the classification results for remedial mathematics, the 76% of cases correctly classified for remedial composition is clearly suggestive of a high degree of predictability.

According to our data, ACT English Subtest Scores, ACT Composite Scores, and the Quarter Hours for which the student was enrolled are not necessarily predictive of successful remediation in composition.

Possible recommendations for program improvement are similar to those suggested for mathematics in including attempts to identify a cutoff score on the composition test, an advisory or orientation program aimed at improving attitudes about the usefulness or importance of the remedial course and exploring ways to better serve the needs of black students. In addition, attempts to improve students' confidence in their writing ability and to better respond to the needs of males and younger students might also be indicated. Again, these are properly matters of institutional responsibility and initiative, based upon realistic appraisal of resources, costs and potential benefits.

The results of the discriminant analysis applied to the remedial reading course appear in Table 3. The factor which emerges is less distinct and statistically significant than that for mathematics, but more so than for the composition course. While there are important similarities in predictor variables in comparing reading to both mathematics and composition, there are some interesting differences as well. Similar to the findings we have already reviewed, and in order of their importance, Reading Pretest Score (.79) and Perceived Usefulness of Course (.55) are revealed as important predictor variables, and the associated recommendations regarding cutoff scores and attitudinal improvement measures would appear to be indicated. Unlike the situation with regard to mathematics and composition, however, race does not appear to be significantly related to successful remediation in reading. An interesting finding is the fact that students scoring lower on the ACT Social Studies Reading Subtest Score are more likely to be successfully remediated. While several equally plausible

explanations for this finding might be offered, including regression toward the mean, perhaps the most convincing might be that which argues that the ACT Subtest Score is not a "true" measure of reading ability, since it also assesses knowledge of social science subject matter.

As was true with both mathematics and composition, a high degree of predictability is to be discerned, with 79% of the cases correctly classified, based upon the predictor variables.

The three discriminant analyses that we have reviewed thus far have all been based upon a common short-range postprogram measure or definition of successful remediation, that is, earning a grade of C or better in the remedial course. And, while there were important differences in the results, scores on "local" faculty-developed pretest and positive attitudes about the usefulness of the course were important predictor variables across the three subject matter areas. Additionally, race was shown to be important for success in remedial mathematics and remedial composition. Equally important and somewhat surprising was the general finding that, with a minor and not clearly interpretable exception, ACT Subtest and Composite Scores did not emerge as variables strongly predictive of successful remediation.

We turn now to consider the results of those two discriminant analyses involving the long-range postprogram measure of successful remediation, namely successful completion of next related course. We shall be particularly interested in discovering whether the patterns we have reviewed are persistent or whether they are changing, and, whether indeed, discriminant factors are revealed at all.

Table 4 displays the results of the discriminant analysis applied to the next mathematics course. While a distinct, discriminating factor is

discernable, it is not as statistically significant as any we have reviewed thus far, and it also contains fewest predictor variables. In order of discriminating power, the predictor variables are ACT Composite Score (.81) and the Quarter Hours for which the student was enrolled while taking the next mathematics course (.50). That the predictability based upon these two factors alone is substantial is indicated by the results of the classification analysis, showing 75% correct assignments of students into the failure and success categories.

When these results are compared to those of our discriminant analysis applied to the remedial mathematics course, some interesting differences are to be observed. Specifically, none of the previously important demographic, ability/performance nor attitudinal variables emerge as predictors of success in the next mathematics course. Apparently, once students are successfully remediated in the sense of earning a C grade or better in the remedial course, any potential disadvantages based upon sex, race, attitude about the course, confidence in ability, and the like, cease to be of importance in the next course. Additionally, it is interesting, that while the ACT Composite Score, a traditional and powerful predictor of collegiate success, did not emerge as significant for the remedial course, it is clearly the dominant predictor variable in the present analysis. Our findings also suggest that students enrolled on a full-time basis have a greater probability of success in the next mathematics course.

The results of the discriminant analysis applied to the next composition course are displayed in Table 5. They reveal a very strong and statistically significant factor. While the analysis shows important similarities to that pertaining to the next mathematics course, there is also one interesting

difference. Like the immediately preceding analysis, an ACT Score (English Subtest) is the most important predictor, with a coefficient of .96, with the quarter hours for which the student was enrolled being next important and having a coefficient of .63. Somewhat puzzling, however, is the -.35 coefficient for the variable of race, which suggests that blacks realize a slight advantage in their likelihood of successfully completing the next composition course. This finding is clearly inconsistent with those discussed earlier and admits of no ready explanation.

That the predictive power of the discriminant function and associated variables for the next composition course is great is clearly revealed by the classification results, which show a full 87% of all cases correctly classified.

Summary and Conclusions

Our results are suggestive of the potential utility of discriminant analysis in formative evaluation studies of remedial education programs. At a regional university in the Southeastern United States, we discovered that the application of discriminant analysis to remedial courses in mathematics, composition and reading yielded distinct and statistically significant factors with important discriminating variables, each providing concrete indications for programmatic improvements. Further applications to the subject institution involving additional and larger samples and to other institutions should allow for a more informed and comprehensive appreciation of the technique's potential applications for the evaluation of remedial programs.

Table 1: Selected Results of Discriminant Analysis Applied to Students (N=48) Enrolled in Remedial Mathematics at a Regional University During the Fall Quarter of 1979.

SUMMARY TABLE

STEP	ACTION Entered	Removed	WILKS' LAMBDA	SIGNIFICANCE LEVEL
1	Math Pretest Score		.581692	.0000
2	Perceived Usefulness of Course		.510888	.0000
3	Race		.472870	.0000

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	CANONICAL CORRELATION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE LEVEL
1	1.11475	.7260372	.4728699	30.332	3	.0000

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNCTION 1
Race	.38215
Math Pretest Score	.84392
Perceived Usefulness or Course	.39459

Table 1 continued on next page.

Table 1 (continued): Selected Results of Discriminant Analysis Applied to Students (N=48) Enrolled in Remedial Mathematics at a Regional University During the Fall Quarter of 1979.

CLASSIFICATION RESULTS

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP 1 GRADE OF D OR F	17	16 (94.1%)	1 (5.9%)
GROUP 2 GRADE OF A, B OR C	31	6 (19.4%)	25 (80.6%)

PERCENTAGE OF GROUPED CASES CORRECTLY CLASSIFIED: 85.42%

Table 2: Selected Results of Discriminant Analysis Applied to Students (N=58) Enrolled in Remedial Composition at a Regional University During the Fall Quarter of 1979.

SUMMARY TABLE

STEP	ACTION Entered	Removed	WILKS' LAMBDA	SIGNIFICANCE LEVEL
1	Composition Pretest Score		.925725	.0506
2	Race		.880490	.0442
3	Sex		.851950	.0510
4	Confidence in Ability		.829032	.0612
5	Age		.794784	.0534
6	Perceived Usefulness of Course		.766254	.0518

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	CANONICAL CORRELATION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE LEVEL
1	.30505	.4834728	.7662541	12.513	6	.0514

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNCTION 1
Sex	-.53326
Race	.34107
Age	.62924
Composition Pretest Score	.42056
Perceived Usefulness of Course	.41999
Confidence in Ability	.61321

Table 2 continued on next page.

Table 2 (continued): Selected Results of Discriminant Analysis Applied to Students (N=58) Enrolled in Remedial Composition at a Regional University During the Fall Quarter of 1979.

CLASSIFICATION RESULTS

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP 1 GRADE OF D OR F	8	5 (62.5%)	3 (37.5%)
GROUP 2 GRADE OF A, B OR C	50	11 (22.0%)	39 (78.0%)

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED: 75.86%

Table 3: Selected Results of Discriminant Analysis Applied to Students (N=39) Enrolled in Remedial Reading at a Regional University During the Fall Quarter of 1979.

SUMMARY TABLE

STEP	ACTION Entered	Removed	WILKS' LAMBDA	SIGNIFICANCE LEVEL
1	Perceived Usefulness of Course		.778449	.0025
2	Age		.722318	.0029
3	Reading Pretest Score		.697595	.0051
4	ACT Social Studies Reading Subtest Score		.630207	.0028
5		Age	.644872	.0014

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	CANONICAL CORRELATION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE LEVEL
1	.55070	.5959261	.6448721	15.574	3	.0014

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNCTION 1
ACT Social Studies Reading Subtest Score	-.82775
Reading Pretest Score	.78679
Perceived Usefulness of Course	.54889

Table 3 continued on next page.

Table 3 (continued): Selected Results of Discriminant Analysis Applied to Students (N=39) Enrolled in Remedial Reading at a Regional University During the Fall Quarter of 1979.

CLASSIFICATION RESULTS

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP 1 GRADE OF D OR F	9	6 (66.7%)	3 (33.3%)
GROUP 2 GRADE OF A, B OR C	30	5 (16.7%)	25 (83.3%)

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED: 79.49%

Table 4: Selected Results of Discriminant Analysis Applied to Students (N=24) Enrolled in the Next Mathematics Course in the Quarter Immediately Following Completion of Remedial Mathematics at the Regional University, Winter, 1980.

SUMMARY TABLE

STEP	ACTION Entered	Removed	WILKS' LAMBDA	SIGNIFICANCE LEVEL
1	ACT Composite Score		.849781	.0613
2	Quarter Hours, Winter, 1980		.810509	.1101

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGENVALUE	CANONICAL CORRELATION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE LEVEL
1	.23379	.4353058	.8105089	4.4120	2	.1101

STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

	FUNCTION 1
ACT Composite Score	.80814
Quarter Hours, Winter, 1980	.49765

Table 4 continued on next page.

Table 4 (continued): Selected Results of Discriminant Analysis Applied to Students (N=24) Enrolled in the Next Mathematics Course in the Quarter Immediately Following Completion of Remedial Mathematics at the Regional University, Winter, 1980.

CLASSIFICATION RESULTS

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP 1 GRADE of D OR F	7	6 (85.7%)	1 (14.3%)
GROUP 2 GRADE OF A, B OR C	17	5 (29.4%)	12 (70.6%)

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED: 75%

Table 5: Selected Results of Discriminant Analysis Applied to Students (N=31) Enrolled in the Next Composition Course in the Quarter Immediately Following Completion of Remedial Composition at the Regional University, Winter, 1980.

SUMMARY TABLE

STEP	ACTION Entered	Removed	WILKS' LAMBDA	SIGNIFICANCE LEVEL
1	ACT English Subtest Score		.535492	.0000
2	Quarter Hours, Winter, 1980		.457858	.0000
3	Race		.436016	.0001

CANONICAL DISCRIMINANT FUNCTIONS

FUNCTION	EIGNEVALUE	CANONICAL CORRELATION	WILKS' LAMBDA	CHI-SQUARED	D.F.	SIGNIFICANCE LEVEL
1	1.29349	.7509887	.4860160	21.997	3	.0001

STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	FUNCTION 1
Race	-.35201
ACT English Subtest Score	.95986
Quarter Hours, Winter, 1980	.63241

Table 5 continued on next page.

Table 5 (continued): Selected Results of Discriminant Analysis Applied to Students (N=31) Enrolled in the Next Composition Course in the Quarter Immediately Following Completion of Remedial Composition at the Regional University, Winter, 1980.

CLASSIFICATION RESULTS

ACTUAL GROUP	NO. OF CASES	PREDICTED GROUP MEMBERSHIP 1	2
GROUP 1 GRADE OF D OR F	11	10 (90.9%)	1 (9.1%)
GROUP 2 GRADE OF A, B OR C	20	3 (15.0%)	17 (85.0%)

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED: 87.10%

Table 6: Summary of Factor Analysis Results for Attitudes of Students Enrolling in the Remedial Mathematics Course at the Regional University in the Fall Quarter, 1979.

FACTORS AND ASSOCIATED ATTITUDINAL STATEMENTS	FACTOR LOADINGS ON VARIMAX ROTATED FACTOR MATRIX FOR ATTITUDINAL STATEMENTS ADMINISTERED: At the Beginning of the Remedial Mathematics Course	At the End of the Remedial Mathematics Course
"PERCEIVED USEFULNESS OF COURSE" FACTOR		
"I will improve (or have improved) my skills in mathematics as a result of taking this course."	.71	.69
"This course will help me in my other academic work."	.83	.73
"This course will help me in my academic program or major."	.79	.75
"This course will be (or was) a waste of my time."	-.68	-.75
"This course will help me later in life."	.51	.46
"CONFIDENCE IN ABILITY" FACTOR		
**"How do you estimate your performance in your high school math courses?"	.51	NA*
**"How do you estimate your ability to do college-level math compared with other students at this university?"	.76	NA*
"I have confidence in my ability to do mathematics."	.68	NA*
"My skills in mathematics are already adequate to do college-level work."	.70	NA*
"I expect to do well in this course."	.60	NA*

*No meaningful Confidence in Ability factor was identified as a result of analysis of the attitudinal posttest.
**These items utilized the following response format: 1. Well below average; 2. Below average; 3. Average; 4. Above average; 5. Well above average. All other items involved: 1. Strongly disagree; 2. Disagree; 3. Undecided; 4. Agree; 5. Strongly agree.

Table 7: Summary of Factor Analysis Results for Attitudes of Students Enrolling in the Remedial Composition Course at the Regional University in the Fall Quarter, 1979.

FACTORS AND ASSOCIATED ATTITUDINAL STATEMENTS	FACTOR LOADINGS ON VARIMAX ROTATED FACTOR MATRIX FOR ATTITUDINAL STATEMENTS ADMINISTERED: At the Beginning of the Remedial Composition Course	At the End of the Remedial Composition Course
"PERCEIVED USEFULNESS OF COURSE" FACTOR		
"I will improve (or have improved) my skills in writing as a result of taking this course."	.69	.68
"This course will help me in my other academic work."	.67	.67
"This course will help me in my academic program or major."	.69	.49
"This course will be (or was) a waste of my time."	-.81	-.64
"This course will help me later in life."	.57	.80
"CONFIDENCE IN ABILITY" FACTOR		
**"How do you estimate your writing performance in your high school courses?"	.70	NA*
**"How do you estimate your ability to do college-level writing compared with other students at this university?"	.56	NA*
"I have confidence in my writing ability."	.53	NA*
"My writing skills are already adequate to do college-level work."	.60	NA*
"I expect to do well in this course."	.45	NA*

*No meaningful Confidence in Ability factor was identified as a result of analysis of the attitudinal posttest.
**These items utilized the following response format: 1. Well below average; 2. Below average; 3. Average; 4. Above average; 5. Well above average. All other items involved: 1. Strongly disagree; 2. Disagree; 3. Undecided; 4. Agree; 5. Strongly agree.

TABLE 8: Summary of Factor Analysis Results for Attitudes of Students Enrolling in the Remedial Reading Course at the Regional University in the Fall Quarter, 1979.

FACTORS AND ASSOCIATED ATTITUDINAL STATEMENTS	FACTOR LOADINGS ON VARIMAX ROTATED FACTOR MATRIX FOR ATTITUDINAL STATEMENTS ADMINISTERED: At the Beginning of the Remedial Reading Course*
"PERCEIVED USEFULNESS OF COURSE" FACTOR	
"I will improve my reading skills as a result of taking this course."	.53
"This course will help me in my other academic work."	.47
"This course will help me in my academic program or major."	.98
"This course will be a waste of my time."	-.41
"This course will help me later in life."	.60
"CONFIDENCE IN ABILITY" FACTOR	
**"How do you estimate your reading performance in your high school courses?"	.44
**"How do you estimate your ability to do college-level reading compared with other students at this university?"	.66
"I have confidence in my ability to understand the materials I read."	.61
"My reading skills are already adequate to do college-level work."	.76
"I expect to do well in this course."	.35

*Attitudinal posttest results were not factor analyzed since these would only be useful for a discriminant analysis of performance in the next related course. As discussed in the text, such analysis was not feasible for the remedial reading program.

**These items utilized the following response format: 1. Well below average; 2. Below average; 3. Average; 4. Above average; 5. Well above average. All others involved: 1. Strongly disagree; 2. Disagree; 3. Undecided; 4. Agree; 5. Strongly agree.

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